



NEWBORNS IN TRAINING: THE AMAZING JOURNEY FROM FERTILIZATION TO BIRTH



7-week
embryo

The Endowment for Human Development

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THE AMAZING JOURNEY FROM FERTILIZATION TO BIRTH

Babies have charmed, fascinated, and baffled adults for millennia. Their impressive capabilities have yet to be fully discovered or appreciated. We love to watch their “firsts”— the first breath, first cry, first smile, first roll, first steps. Since these mysterious little ones achieve so many milestones long before birth, key insights into their world can be gained by looking at their development from the very beginning.

THE FIRST 8 WEEKS AND BEYOND

Human development begins at fertilization and unfolds with startling speed, as the single-cell embryo becomes a 1¼-inch long, one billion-cell embryo with more than 4,000 permanent body parts during the 8-week embryonic period. During this time, all body systems and most body parts appear and begin to function. The 8-week brain, spinal cord, heart, and limbs are remarkably complex and, like the embryo itself, closely resemble their newborn counterparts.



7½-week embryo

The fetal period (8 weeks to birth) is marked by the rapid emergence of increasingly complex abilities and an enormous increase in size.

TRAINING FOR INFANCY BEGINS LONG BEFORE BIRTH

Newborns are not only charming, they are surprisingly capable. For example, they can move in all kinds of ways, breathe air, breastfeed, and much more. Newborns may look “new” but they have practiced essential “life skills” for many months before birth, usually beginning just as soon as the necessary body parts appear.

Movement, both spontaneous and reflexive, begins by 5½ to 6 weeks, coinciding with the first appearance of muscles. Lightly touching the mouth region causes the embryo to withdraw its face. First movements include turning the head side to side and subtly twisting the trunk. Hand and leg motions begin by 7 weeks, at which time a “startle” response may be seen. By 7½ weeks the hands and feet can touch in the midline and hand-to-mouth motions begin. The first sign of hand preference (right- or left-handedness) appears at 8 weeks. By this time these little ones can roll over and even perform somersaults! Stretching begins at 9 weeks and complex facial expressions are seen by 11 weeks.

A full-term newborn has been moving for 32 weeks before birth!

Breathing has a similar history. The diaphragm (primary breathing muscle) is substantially formed by 6 weeks, and hiccups, caused by a twitching of the diaphragm, begin shortly thereafter. By 8 weeks the diaphragm is complete, and intermittent breathing motions begin — leaving a full 30 weeks to strengthen this muscle for continuous service after birth. Two familiar breathing variants, the sigh (a long, deep exhalation) and the yawn (a long, deep inhalation), begin at 9 and 9½ weeks, respectively.

A full-term newborn has been training to breathe for 30 weeks!

Breastfeeding involves latching on to mom’s nipple, sucking to stimulate the release of breast milk, and swallowing. Here’s why most newborns adapt to breastfeeding so easily:

- Lightly touching a newborn’s cheek will cause the little one to turn toward the touch and try to latch on to something and suck. This “rooting reflex” is helpful for breastfeeding as a baby seeks out mom’s nipple. “Rooting” is not new. It first appears just 9 weeks after fertilization.
- Sucking motions are also first seen at 9 weeks. In fact, thumb sucking was photographed at 9 weeks in utero by the famous A. W. Liley, known as the “Father of Fetal Therapy.”
- Swallowing is a complex maneuver, which requires coordinated action by the nerves and muscles of the esophagus to deliver mouth contents to the stomach. Swallowing amniotic fluid also begins at 9 weeks.

A full-term newborn has been actively preparing to breastfeed for 29 weeks!

PRACTICE MAKES PERFECT

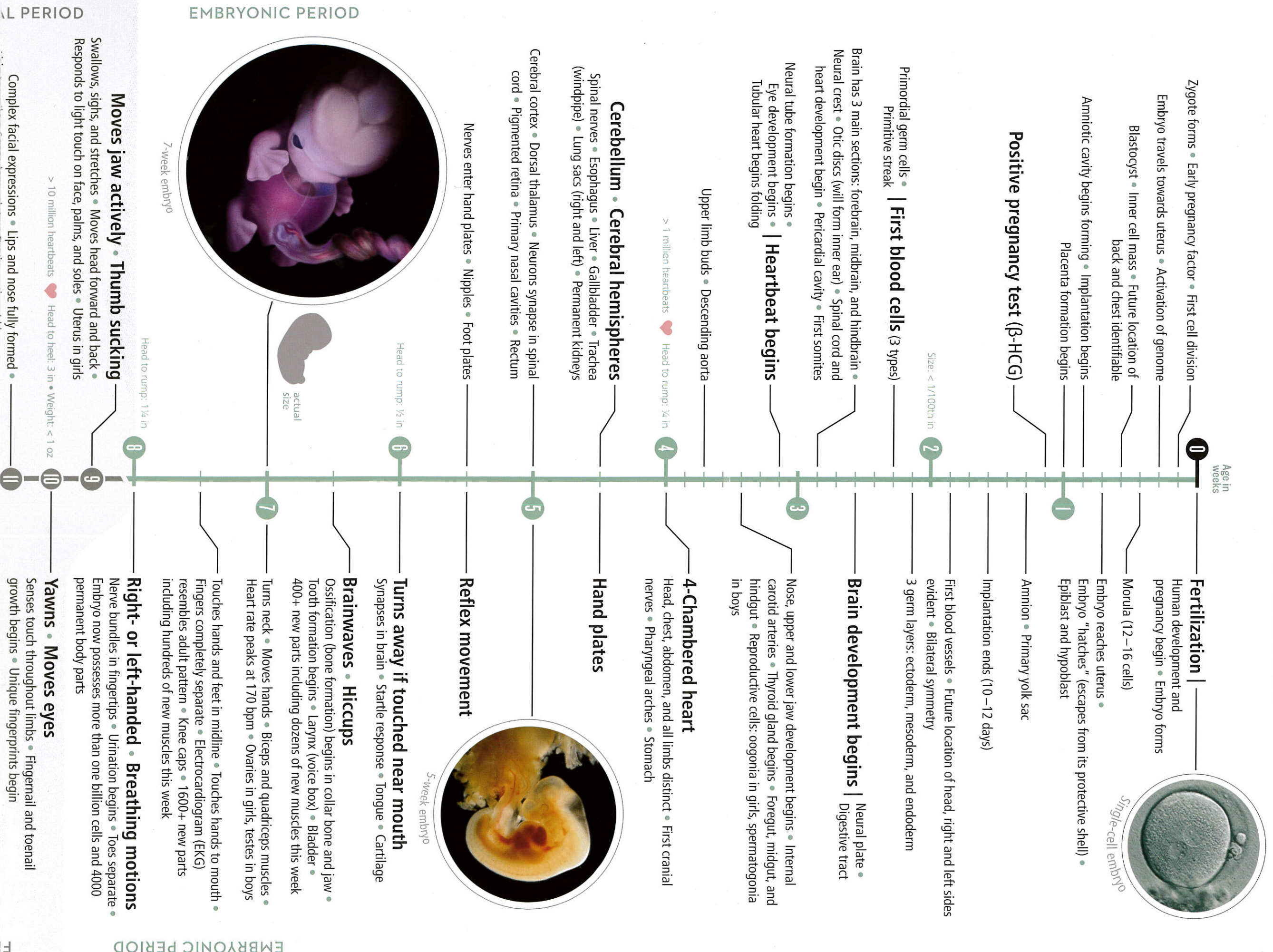
A newborn baby is like a world-class athlete or musical prodigy, whose success comes after practicing essential skills countless times until perfected. However, the level of teamwork between a pregnant mom and her developing baby far exceeds anything possible in sports or music.

In just 38 weeks, the single-cell embryo gives rise to the newborn’s 200+ cell types and two trillion cells, which are superbly organized into thousands of body parts and a dozen exquisitely functioning body systems. It’s enough to make any mom or dad proud!



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THE AMAZING JOURNEY FROM FERTILIZATION TO BIRTH



AL PERIOD

EMBRYONIC PERIOD

Responds to light touch nearly everywhere

Ear drums • Tooth dentine

Head to heel: 5 in • Weight: 2 oz

Taste buds | Cheeks complete • Bowel movements • Distinct male or female genitals

Blood formation begins in bone marrow • Fat around trunk • Several digestive enzymes produced

> 20 million heartbeats • Head to heel: 8 in • Weight: 6 oz

Mom feels movement (quickening) 14–18 weeks

Head to heel: 10 in • Weight: 9 oz

Hormonal stress response to invasive procedures • Enamel in teeth



15-week fetus

Number of oögonia (early eggs in ovaries) peaks at about 7 million • Motion in voice box • Hair on scalp • Breathing, movement, and heart rate follow circadian rhythms

Head to heel: 11 in • Weight: < 1 lb

Age of viability • Hearing begins

If born prematurely, up to 40% survive • Eyes reopen • Organ of hearing (cochlea) reaches adult size • REM sleep

If born prematurely, up to 63% survive

Head to heel: 12 in • Weight: 1½ lbs

Breathing motions seen 14% of the time

All skin layers, structures, and glands present

Head to heel: 14 in • Weight: 2 lbs

Blink-startle response (earlier in girls)

Rods and cones in retina

Sense of smell and taste | Eyes produce tears

Head to heel: 15 in • Weight: 2½ lbs

Pupils react to light | Continued rapid brain growth

Distinguishes high- and low-pitched sounds

Head to heel: 15 in • Weight: 3¼ lbs

Breathing motions seen 40% of the time

Sleep patterns become cyclical

26-week fetus



Alveoli • All neurons formed

Head to heel: 18 in • Weight: 5 lbs

Voice and music memories forming

Amniotic fluid volume peaks

Head to heel: 18½ in • Weight: 5¾ lbs

Nails reach fingertips

Firm hand grip

Drinks up to 25 ounces daily

> 50 million heartbeats • Head to heel: 19 in • Weight: 6¾ lbs

Labor • Baby is born! Transitions to air breathing • Now possesses two trillion cells



Newborn baby

Full-term pregnancy lasts 38 weeks when measured from fertilization to birth, or 40 weeks, if measured from the beginning of a woman's last menstrual period. All ages here refer to the time since fertilization. If you are pregnant, you can make a free Little One Pregnancy Calendar on Facebook to learn much more about your developing baby.

DID YOU KNOW?

Human development and pregnancy begin at fertilization (or conception). Fertilization begins within a woman's uterine (or Fallopian) tube when a man's sperm makes contact with a woman's oocyte, forming a single-cell embryo. It ends with the union of mom's and dad's chromosomes. Fertilization is a 24-hour process so there is no such thing as "the moment of fertilization."

The heart begins to beat 22 days after fertilization. It beats more than one million times by 28 days and 53 million times before birth. By 7 weeks the heart is largely complete, and by 7½ weeks the heart's electrical pattern (called an EKG or ECG) is surprisingly similar to that of newborns and adults.

The first pregnancy hormone, called Early Pregnancy Factor (or EPF), appears in a woman's bloodstream as early as 24 hours after fertilization.

Brain development begins 18 days after fertilization with the emergence of the neural plate. The cerebellum and cerebral hemispheres first appear at 4½ weeks. Brainwaves have been recorded by 6½ weeks. By 32 weeks the brain has its full complement of nearly 100 billion (10¹¹) neurons (nerve cells). Each neuron eventually connects (synapses) with up to 200,000 other neurons, creating an electrical network of incalculable complexity.



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